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THE DESIGN OF LOW-COST HOUSING IN RELATION TO LOCAL CONDITIONS

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THE DESIGN OF LOW-COST HOUSING IN RELATION TO LOCAL CONDITION

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1. In almost all countries, efforts are being made for developing housing projects which will suit different social and economic conditions of the people. The crucial problem is how to achieve houses that will suit families whose income does not cope with the number of their members or permit to pay the rent of a suitable dwelling. Some governments have restored to subsidize housing projects for low income groups. But subsidies alone are not adequate, the should be reinforced by other methods for minimizing the construction costs. The following is a presentation of some examples carried out in the U.A.R.

PART I

Case Study: "The redevelopment plan of Port Said"

The Impact of Socioeconomic forces on the location and character of residential developments.

2. The distribution of population in any country is a product of several competitive forces of geographic economic, social and political character Population can be classified into urban, rural-farm, and rural-nonfarm inhabitants according to the place of residence and the nature of work. Cities are social facts of many dimensions. In the field of planning, they are described as moral entities, as products of human history, as a relation between man and his habitat, as a set of economic interrelationships, as centers of political control and as a distinct way of human existance. Those of the same creed, religion, background, race, and income cluster together, usually inside or close to the sectors where their associates gathered.

3. Planners have been holding the hypothesis that there is a strong correlation between spatial and socioeconomic differences in a community. The degree of validity of this hypothesis among the inhabitants of the city of Port Said is the subject of the following discussion.

4. The city lies at the north point of the Suez Canal on the Mediterranean. It was founded in 1868 as a commercial port for maritime navigation and still owes its existance to the operation of the Suez-Canal. Since the creation of the Suez-Canal Company it discriminated in wages and jobs between the natives and foreign employees. Important jobs with very high wages were given to the foreighers while minor posts with relatively much lower wages were given to the natives. Those two cla ses created

another class of population to serve them. Consequently, three classes of inhabitants with distinctive characteristics composed the population of the city. As a result, the city grew into three sectors different in character, the European quarter, Arab quarter N° I and Arab quarter N° II. Table I shows the population of each quarter by nationality.

Table I
Population of Port Said by nationality
(1957)

Quarter	Total	Egyptian	Foreign
European	51572	40320	11252
Arab I	94011	93960	51
Arab II	75998	75998	

5. From this table it can be seen that almost all the foreigners lived in the European Quarter. Although those foreigners were of different nationalities yet, they clustered together owing to similar habits and backgrounds. Because of their high wages they occupied the best location in the city which looked on both the Mediterranean and the Suez-Canal. Their quarter was characterized by low density of population (one person per room) and by high class buildings provided with high standard services and utilities.

6. Native inhabitants represented two categories of population. One comprised those who worked for the ex-company in minor jobs and in jobs related directly to the operation of the canal. The second category encountered the filling part of the population engaged in service activities, fishing, agriculture and related works. The two categories lived in Arab Quarter N°1 and Arab Quarter N° II respectively. Arab Quarter N° I was characterized by middle-class buildings with high density (2 persons per room) and was located next to the European Quarter. Arab Quarter N° II was located to the south of Arab Quarter N° I, it was characterised by very high density (3 persons per room) and the lack of services and utilities, Shaks and wooden houses were the overwhelming majority of the structures therein. Table II shows the distribution of population by occupation in each quarter.

Table II

Distribution of population by occupation in Port-Said excluding children under 5 years (1957)

Classification	Total engaged	European		Arab I		Arab II	
		No engaged	% of total engaged	No engaged	% of total engaged	No engaged	% of total engaged
Agricul., fishing	4009	265	6	1030	25	2714	69
Industrial and Mining	10186	1265	12	5018	50	3903	38

Construction	1769	213	12	906	51	650	37
Transport and Common	10614	1650	15	5234	50	3730	35
Commerce	19960	3516	17	9640	48	6804	35
Private services	70742	13059	18	31821	45	25862	37
P.Services and social work	11368	2740	24	5507	48	3121	28
Undefined	25250	6033	24	1499	51	7718	25
Unemployed	19442	1599	8	9345	48	8498	44
Total	173340	30340		80000		63000	

1. Thefoblowing main observations can be obtained from table II:

(a) The majority of those engaged in low income jobs (agriculture and fishing) reside in Arab Quarter N° II.

(b) The European Quarter had the least percentage of low-wage category and nonemployment.

(c) Arab Quarter I was the place of residence of the majority of those engaged in medium-income jobs.

(d) In each quarter, resided a certain percentage of each occupation.

8. It may be concluded that in general, people of the same kind of work and wage cluster together. However it would appear that social status or prestige, the attitudes and sentiments and the subjective awareness are as important in determining the residential association as family income. This conclusion is evidenced by the intrusion of those engaged in minor jobs into the European quarter as illustrated in table II.

9. In the redevelopment plan of Port Said, due care was given to the location of new housing projects so as to adhere with prevailing socioeconomic forces. A neighbourhood was constructed at Menzalah canal abutting the lake and close to Arab quarter N° I for housing those engaged in fishing and agriculture with economic apartment buildings for low income groups. Another area was appropriated to the south of the city for the construction of a barn enclosure with a small residential tract for those engaged in related activities. Eight neighbourhoods were constructed for medium-income groups near arab quarter N° I, with gross density of 100 persons per acre. Other vacant areas close to the European quarters were appropriated for housing high-income groups. It was provided that the improvement on these areas should be subject to certain conditions in order to

maintain the standards prevailing in their environments. Necessary services and utilities were provided in each of the three classes of residential developments, taking into consideration the needs and the improved standards adopted for their respective occupants.

The Effects of socio-economic forces on the design of the dwelling unit:

10. The design of the dwelling unit is a clear reflection of the social and economic status of its occupants. Social index is affected by the number of family members and the work and education of the family head. Economic status is affected by family and per capita income. After the aggression and its subsequent economic depression in the city of Port Said, economic status was the most important factor for the selection of the dwelling unit. Therefore, in order to conform with the beneficiaries ability to pay, the redevelopment plan of Port Said provided for several designs of dwelling units taking into consideration social factors and the number of family members to a certain extent.

11. For medium income groups, the plan provided free planned apartment buildings with housing units of 2 or 3 rooms, a hall a bath, and a kitchen. For lower income beneficiaries,it provided apartment buildings with housing units of 2 rooms and utilities. For low income groups, raw houses each consisting of one room, a bath,a kitchenette and a yard were provided. In distributing the dwellings, a relation between the rent value and family income was taken into consideration. Also the size of the dwelling was related to the number of members in each family. Due care was given to social association among the beneficiaries. In order to realize the preceding cocepts, the following conditions were required to be fulfilled from applicants:

(a) They should be among those whose homes were destroyed during the aggression.

(b) The applicant should be a head of a family.

(c) The applicant should not own a house in Port-Said or its vicinity.

12. Requests which fulfilled these conditions were considered, giving priority to the following cases:

(a) Families of martyrs who had been living with them in the same dwelling.

(b) Larger families.

(c) Families with low incomes on the condition that their income was not less than 3 times as much as the rent of the dwelling applied for..

13. Table III shows the number of families who had forwarded requests and who fulfilled the preceding requirements.

TABLE III
Distribution of requesting families
(by income and number of members)

Family income brackets each month in Egyptian pounds	Number of Families									Total
	2 persons	3 pers.	4 pers.	5 pers.	6 pers.	7 pers.	8 pers.	9 pers.	10 pers.	
Less than 9	59	73	85	74	67	44	10	11	3	431
over 9 to 12	82	119	142	176	134	109	56	19	20	857
over 12 to 15	53	113	178	159	145	115	104	37	25	929
over 15 to 20	41	101	140	186	181	171	121	71	61	1073
over 20 to 25	30	48	71	96	78	76	60	41	42	542
over 25 to 30	28	32	35	68	41	51	29	28	36	348
over 30	6	16	18	35	29	50	51	30	28	243
TOTAL	299	502	669	794	675	616	416	237	215	4423

The Estimation of Rent:

14. The rent estimated for the dwellings was determined by the size of the dwelling, its location and the advantages possessed by high floors over lower ones. Efforts were made to make the rent value much lower than their commercial value in the market. In order to reach this aim, the government gave great assistance of which are:

(a) Not taking into account the value of the land in the capital on which the estimation was based.

(b) Not including the cost of public utilities in the construction cost.

(c) Setting a long period for capital amortisation.

(d) Not taking any rate of interest on the sums spent for construction, merely an annual unchanging rate of 2% for management, administration and maintenance was decided.

15. From the experience obtained from the execution of the redevelopment plan of Port Said, it was found that some of the beneficiaries had declared false information about their income either to get large size homes or to be eligible to rent a home from the housing authority. Those who declared incomes higher than they had became unable to pay the rent while those who declared lower incomes were crowded in the dwelling unit given to them. It is therefore recommended that better methods for getting real information should be adopted.

The standardization of lots yards, rooms, windows and doors, as an economic necessity:

16. The principle of standardization has been widely advocated in recent years. Several authorities have pointed out its economic benefits. In the following, the standardization of lots, rooms, windows and doors will be discussed with respect to methods of standardization, benefits that can be realized and factors limiting its extensive use.

Standardization of lots and yeards:

17. Almost all developed or developing countries have adopted subdivision regulations, dealing with platting schemes, design of streets, minimum width of lots and the provision of utilities. The requirements of these regulations differ greatly from one place to another according to the standards required for any particular community. Very few countries have provided for zoning ordinances regulating the use of land, height of structures, size of yeards and the built-up area on each lot.

18. In the U.A.R. where no zoning ordinances are adopted, subdivision regulations are supplemented by building codes, which regulate among other things height of buildings and size of yards. Under these regulations and codes which require a minimum width of the lot and relate the size of the yard and its minimum width to the height of building, different standards of buildings with varying legal heights and uses could exist. The inevitable result would be haphazard developments with uncontrolled density of population. Consequently, no related plan-

ning for public utilities and services can be reached, thus impairing the expenditure of the community without corresponding returns. Therefore, the need for controlling density becomes urgent.

19. For help in controlling the density of population in a community, the provision of a zoning ordinance is necessary. But in already grown cities, where different legal uses of land has been scattered without control over a long period of time, it would be very difficult to regulate the use of land by zoning. The standardization of lots and yards in new and developing neighbourhoods is an important tool as well as a means for controlling density.

Methods of standardizing lots and yards:

20. For developing a new residential neighbourhood, social and economic conditions of its prospective residents should be studied. Sectors for those of similar status should be delineated. Based on the previous studies, the size and character of the dwelling units can be determined and the size of lots can be selected. Lots can be standardized in width and depth. Corner lots can be considered special cases to be developed subject to certain conditions. Side, rear and front yards can be fixed to give a certain height according to current building codes. Consequently, the ultimate development of the neighbourhood and the probable future number of people therein can be estimated.

Benefits of standardizing lots and yards:

21. Some of the benefits that can be realized by standardizing lots and yards are listed in the following:

(a) The possibility of estimating potential inhabitants in the planning area, thus helping to prepare an integrated plan for utilities, major thoroughfares and public services in a sound manner.

(b) The even distribution of light and air among the dwelling units which can best be realized by combining standardized yards.

(c) The protection of the improvements on the land against possible deterioration which might result from the incompatibility of different standards of buildings.

(d) The encouragement of dwellers possibly of similar social and economic conditions to cooperate in conserving their neighbourhood against factors of blight.

Factors limiting the use of standardization:

22. Although it appeared that the standardization of lots would be beneficial; there are limitations on its extensive use, some of which are listed in the following:

(a) The repetition of one design or two in a neighbourhood might create monotony, thus adversely affecting its live ability. However, varying elevations with good architectural design would help off set such feeling.

(b) As land requirements for uses other than residential depend on the extent of their respective activities,

sites for these uses cannot be standardized.

Conclusion:

23. From the previous discussion, it can be concluded that the standardization of lots and yards would help in controlling density of population. It would increase the benefits for the occupants and would reduce the expenditures of the community. However it is impractical for uses other than residential.

Standardization of rooms, windows and doors:

24. The standardization of rooms, windows and doors is a means for reducing the construction cost of buildings. Standardization of room sizes would allow for the use of prefabricated materials for building and roofing. A room size can be standardized by designing the width and depth of the room as well as the height of the storey equivalent to the multiplications of prefabricated bricks and slabs. For roofing either by concrete slabs, vaults or dames, necessary forms should be prepared. If the room sizes are standardized these forms can be used several times with the least loss, thus reducing both the time and cost of construction.

25. The standardization of windows and doors also would help to reduce the cost of construction. A central and economic production of doors and windows based on modern technology can be provided for inconvenient locations from which the production can be shipped for use. But it would be much more beneficial if the standards of width and height of the unit comply with the available size of materials. For the purpose of illustration, let us consider that the wooden beams available for making the frames of windows are four meters long. What would be the most economic sizes of windows? To answer this question, an illustration is presented in Table IV, which shows that the

Table IV

Number of frame parts, disposed pieces of beams four meters long

Measures of windows		Parts that can be made		disposed pieces (m)
Width (m)	Height (m)	Horizontal parts	Vertical parts	
1.00	1.00	2	2	-
0.80	1.20	2	2	-
0.70	1.30	2	2	-
1.50	1.00	2	1	-
1.40	1.20	2	1	-
1.00	1.30	1 or 2	1 or 2	0.70 or 0.40
1.20	1.30	1 or 2	1 or 2	0.30 or 0.20

size of the opening whatever it may be can be standardized in a way that the loss of material is eliminated.

Conclusion

26. It can be concluded that the standardization of rooms windows and doors reduces the construction cost of buildings. In selecting the standards, due care should be given to the sizes of building materials available.

PART II

Case Study: "The redevelopment plan of Kena"

The advantages and drawbacks of building by prefabricated materials:

Introduction:

27. On the 20th of December 1954, a heavy rain fell on the hills near the city of Kena, the capital of Kena province. Rainfalls assembled at the bottom of the hills and flooded the city so vehemently that all existing precautions failed to protect the city. As a result, 2830 dwelling units were demolished and 3745 families became homeless. The authority responsible for rehabilitating the city was faced by the problem of housing such number of people in the least time possible. Tents and temporary shleters were immediately provided and a redevelopment plan for the city prepared taking into consideration immediate problems and future needs.

28. One of the main problems that faced the authority was the selection of building materials which would help execute housing projects within their fixed time. A study was made to decide on the suitable materials with due attention given to the ultimate utilization of those existing in the locals. The study revealed so many factors which led the authority to its final decision in this respect. Some of these factors are the subject of the following discussion.

Factors affecting the selection of building materials:

29. In the selection of building materials for housing projects in Kena, there was a number of determinant factors some of which are:

(a) The lack of adequate quantity of red bricks in the locale

(b) The long time necessary for preparing the quantity of red bricks required for the projects

(c) The climatic conditions of the area, characterized by high temperature in spring, summer and autumn seasons

(d) The presence of sand, gravel, pebloles and quarries near the city and the availability ofsample supply of labour force in the locale

(e) The convenience of mud-brick for heat insolation and the unsuitability of using it due to the probability that the area might be flooded again

(f) The question ableness of the results of using stabilized mud-bricks under such conditions and the long time necessary for developing improved production.

30. Considering the previously mentioned factors, and that dwellings should be built in the least time possible, it was decided to use perforated cement bricks and slabs for building and roofing. Elements necessary were abundant in the locale, except the cement which was shipped on the Nile and by rail at low cost. It was found that bricks and slabs could be prefabricated locally. Adequate equipment were transported immediately to the city and sheds and water basins were built on site for the purpose of curing and setting the cement elements. The work was carried on until the projects were completed realizing several advantages which will be discussed in the following:

Advantages of using prefabricated building materials:

31. In the execution of the redevelopment projects of Kena, several benefits were realized, some of which are listed in the following:

(a) An economy in time as the projects were completed in their fixed short time.

(b) The unnecessity of plastering the walls and roofs as the prefabricated materials were shaped in metal forms and had smooth surface.

(c) An economy in the timber necessary for shuttering.

(d) The insolation of heat made possible by the use of prefabricated hollow bricks and slabs.

Drawbacks of using prefabricated building materials:

32. From the experience obtained during the execution of the redevelopment projects of Kena, it was found that using prefabricated materials for building construction had a number of drawbacks some of which are listed in the following:

(a) A reduction in the labour force utilized because of the use of mechanized equipment which in turn resulted in a reduction of the money in-put in the city.

(b) The inadequacy of curing and setting prefabricated materials due to the characteristics of local climate and the short time fixed for construction.

(c) The excess of broken units due to the lack of complete curing and setting.

33. From the previous discussion, it is evident that the economic side of using prefabricated building materials was off-set by the drawback accompanied by their use. The sole important benefit that could be realized was the completion of the projects in a short time.

Conclusion:

34. It can be concluded that the use of prefabricated building materials is beneficial in projects at remote places

and where time factor is more important than economic side. Full prefabrication would be more successful in countries well advanced in industry, and where all mechanical equipment and necessary spare parts are available at a reasonable cost, and where wages are comparatively high and also when the volume of the project, is sufficiently big so as to cover economically the amortisation of the capital invested in the mechanical equipment used in the project. Where normal conditions prevail and where local building materials are avaiable and labour wages are comparatively low, ordinary methods of building become more economical. This conclusion was also reached when examining the tenders of contractors bidding for the housing projects for the reconstruction of Port Said in 1957, since the estimated cost of construction by prefabricated materials was 22% higher than that of building by ordinary methods.

PART III

Case Stuty: School planning in the UAR

Intoduction:

35. Before the advent of the revolution of the UAR in July 1952, there was no plan for the establishment of public buildings. Sometimes, they were centered in main cities and in some cases, they were built according to the influence of those in power. Several governmental authorities were entitled to develop such buildings with no coordination among them. As a result, public buildings were not distributed according to their service areas with respect to location, size or design. In some places, there were more than one building for providing one particular service, while in other places such service was lacking. Before 1952, the average number of school buildings built by the government was five schools per year. These buildings were built so luxurious that the construction cost of the school ranged from L.E. 25000 to L.E. 40000. This small number of school buildings was supplemented by renting structures built for other purposes. The rents were high and the buildings were unsuitable for the purpose they were rented for.

36. After the revolution, the government was faced by such heritage, and furthermore, the demand for more schools to meet the response of people for education, the increase in number of population and the new government policy for fighting against illiteracy. The task which faced the government was great and the budget possibilities were so limited, which led to the creation of a body called the educational building corporation, financed mainly by loans from banks at a low rate interest, thus allowing the investment of large sums of money in building greater number of schools on long pay terms. This body which was created in 1952 and had the objective of building schools only has proved to be successful. Later in 1958 it was charged for the design and execution of other public buildings and its name was changed to The Corporation of Public Buildings. Table V shows the various buildings which have been constructed within the years 1952-1962.

T A B L E V

Number and Distribution of Public Buildings Constructe in 1952 - 1962

Governorates	Ministry of Education		Ministry of Communication	Ministry of Justice	Ministry of Interior	
	Primary schools	Technical & General schools	Offices for Mail, Telephone and Telegraph	Courts Buildings	Polics Stations	Police Units
Middle & North Cairo	98	12	-	-	-	-
South Cairo	66	8	-	-	-	-
Alexandria	64	7	-	1	-	-
Damanhour	55	4	8	6	1	8
Tanta	75	4	11	2	-	1
Kafr El Sheikh	33	2	2	4	1	7
Shebin El Kom	43	4	7	6	-	-
Benha	46	5	9	3	-	1
Mansoura	53	9	14	3	-	10
Damietta	20	1	2	1	1	4
Zagazig	57	6	8	4	1	5
Canal	53	3	-	-	1	2
Giza	64	4	10	3	-	1
Beni Suef	39	2	7	1	-	-
Fayoum	51	7	7	2	-	3
Menia	60	3	15	4	1	2
Assiut	54	4	11	4	-	-
Sohag	39	1	15	5	5	8
Kena	45	4	6	4	2	8
Asswan	19	4	3	1	1	1
TOTAL	1058	94	135	54	14	61

37. The number and distribution of public buildings presented in Table V were based on the real needs taking into consideration the ultimate utilization of existing buildings. For the purpose of illustration, let us consider the case of the city of Cairo. Although its population amounts to about 3.5 millions which is about 12% of the total population at the UAR, its share of school buildings constructed was about 16%, while it had no share of newly constructed public buildings as it had already its needs in that respect.

38. The responsibility of the Corporation was not merely the execution of a number of public buildings. It was also required to reduce the construction cost as much as possible. Following is a brief of the efforts made and the results obtained with this respect.

The reduction of construction cost:

39. Since its creation, the Corporation has exerted every effort possible to construct the buildings at the least cost. Efforts were aimed at the simplification of designs, the selection of suitable building materials, the ultimate utilization of local materials, the determination of size according to the extent of its anticipated use and at the same time improving the standards of the services provided. Specialists of related fields were selected by the Corporation from different departments to carry on the job. Spiritual and material appreciation for those engaged in the work was a good procedure for getting first class work. As a result of the efforts made, the Corporation could built the primary school which is adequate for 500 students within L.E. 11000. Such school comprises 13 classrooms 8 x 5.50, mts., together with necessary rooms, stores and utilities.

40. Methods of building construction followed the characteristics of the locales. Reinforced concrete in skeleton types, bearing walls of red or sand bricks were used in the construction of school buildings. Different designs of schools were prepared to suit any site from the stand point of size and orientation of buildings. The kind, size and position of openings were designed to meet the standards required with respect to the amount and direction of light and air. Desks and tables were made in different designs that suit the age of the students.

41. One main problem has been facing the Corporation, that is the provision of necessary schools and other public buildings in the slum areas of cities. These slums are usually characterized by high density, high cost of land and the presence of old structures. Their clearance projects require a large budget and a long time. The question is whether the Corporation should build the necessary buildings according to the present population or based on the future plans for these slums after being cleared out. If schools are built according to present population, some of them would inevitably be useless after the development of future plans. On the other hand, if they are built according to future population, some of the inhabitants would not be served, otherwise, they have to seek the service

at locations distant from their place of residence. It is recommended however that the number of schools and other public buildings should meet the requirements of the present population. The design of public buildings in excess of those required in the future plans of the slums should be flexible to permit their use for other purposes connected with future development.

419 E - Oct. 1962 - 1,600